

Claims

1. A process for increasing the molecular weight and/or for the modification of a polycondensate, which process comprises adding to the polycondensate

a) at least one bis-acyllactam;

b1) at least one phosphite, phosphinate or phosphonate; or

b2) at least one benzofuran-2-one type compound or

b3) at least one phosphite, phosphinate or phosphonate and one benzofuran-2-one type compound

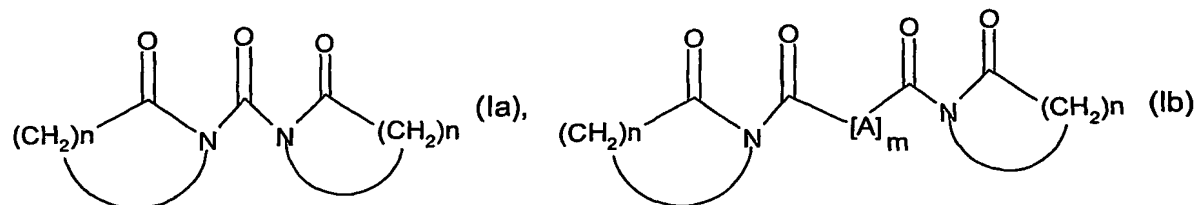
and processing the mixture in the melt.

2. A process according to claim 1 wherein the polycondensate is an aliphatic or aromatic polyester, an aliphatic or aromatic polyamide or polycarbonate, or a blend or copolymer thereof.

3. A process according to claim 1 wherein the polycondensate is polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethyleneterephthalate (PEN), a copolyester, PA 6, PA 6,6, a polycarbonate containing bisphenol A, bisphenol Z or bisphenol F linked via carbonate groups.

4. A process according to claim 1 wherein the polycondensate is PET or PBT or a copolymer of PET or PBT.

5. A process according to claim 1 wherein the bis-acyllactam is of formula Ia or Ib



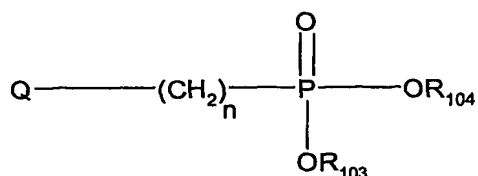
wherein A is C_1 - C_{18} alkylen, C_2 - C_{18} alkylene interrupted by at least one oxygen atom, C_1 - C_{18} alkenylene, phenylene, phenylene- C_1 - C_{18} alkylene, C_1 - C_{18} alkylene-phenylene, or C_1 - C_{18} alkylene-phenylene- C_1 - C_{18} alkylene;

m is 0 or 1 and

n is a number from 3 to 12.

- 53 -

6. A process according to claim 1 wherein the phosphonate is of formula II



(II), wherein

R_{103} is H, $\text{C}_1\text{-C}_{20}$ alkyl, unsubstituted or $\text{C}_1\text{-C}_4$ alkyl-substituted phenyl or naphthyl,

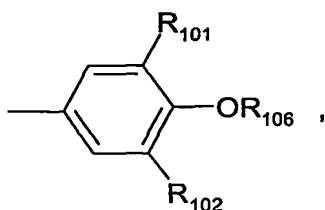
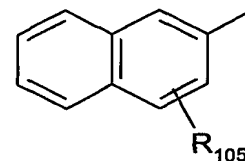
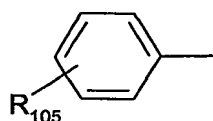
5 R_{104} is hydrogen, $\text{C}_1\text{-C}_{20}$ alkyl, unsubstituted or $\text{C}_1\text{-C}_4$ alkyl-substituted phenyl or naphthyl; or M^{r+} / r ,

M^{r+} is an r-valent metal cation or the ammonium ion,

n is 0, 1, 2, 3, 4, 5 or 6, and

r is 1, 2, 3 or 4;

10 Q is hydrogen, $-\text{X}-\text{C}(\text{O})-\text{OR}_{107}$, or a radical



R_{101} is isopropyl, tert-butyl, cyclohexyl, or cyclohexyl which is substituted by 1-3 $\text{C}_1\text{-C}_4$ alkyl groups,

15 R_{102} is hydrogen, $\text{C}_1\text{-C}_4$ alkyl, cyclohexyl, or cyclohexyl which is substituted by 1-3 $\text{C}_1\text{-C}_4$ alkyl groups,

R_{105} is H, $\text{C}_1\text{-C}_{18}$ alkyl, OH, halogen or $\text{C}_3\text{-C}_7$ cycloalkyl;

R_{106} is H, methyl, trimethylsilyl, benzyl, phenyl, sulfonyl or $\text{C}_1\text{-C}_{18}$ alkyl;

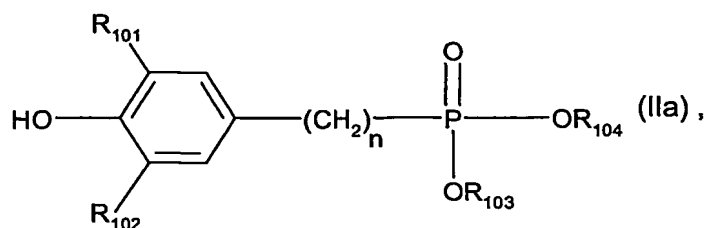
R_{107} is H, $\text{C}_1\text{-C}_{10}$ alkyl or $\text{C}_3\text{-C}_7$ cycloalkyl; and

X is phenylene, $\text{C}_1\text{-C}_4$ alkyl group-substituted phenylene or cyclohexylene.

20

7. A process according to claim 6 wherein the phosphonate is of formula IIa

- 54 -



wherein

R_{101} is H, isopropyl, tert-butyl, cyclohexyl, or cyclohexyl which is substituted by 1-3 C_1 - C_4 alkyl groups,

R_{102} is hydrogen, C_1 - C_4 alkyl, cyclohexyl, or cyclohexyl which is substituted by 1-3 C_1 - C_4 alkyl groups,

R_{103} is C_1 - C_{20} alkyl, unsubstituted or C_1 - C_4 alkyl-substituted phenyl or naphthyl,

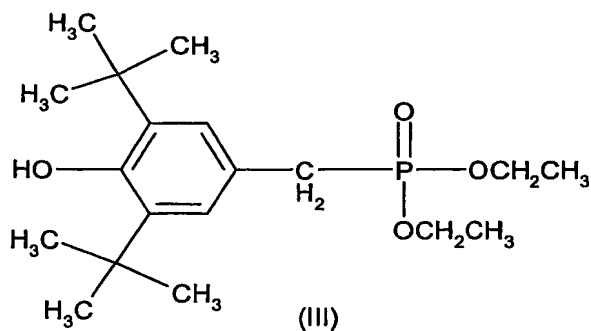
R_{104} is hydrogen, C_1 - C_{20} alkyl, unsubstituted or C_1 - C_4 alkyl-substituted phenyl or naphthyl; or

M^{r+} / r ;

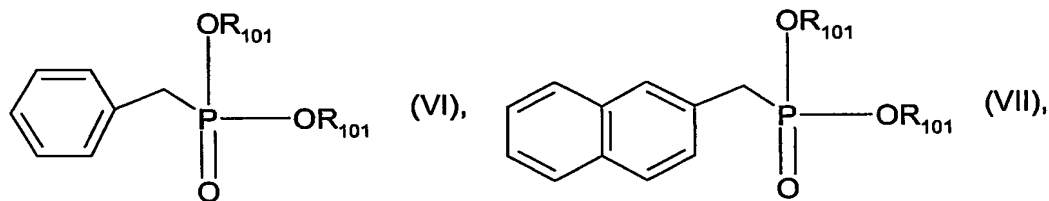
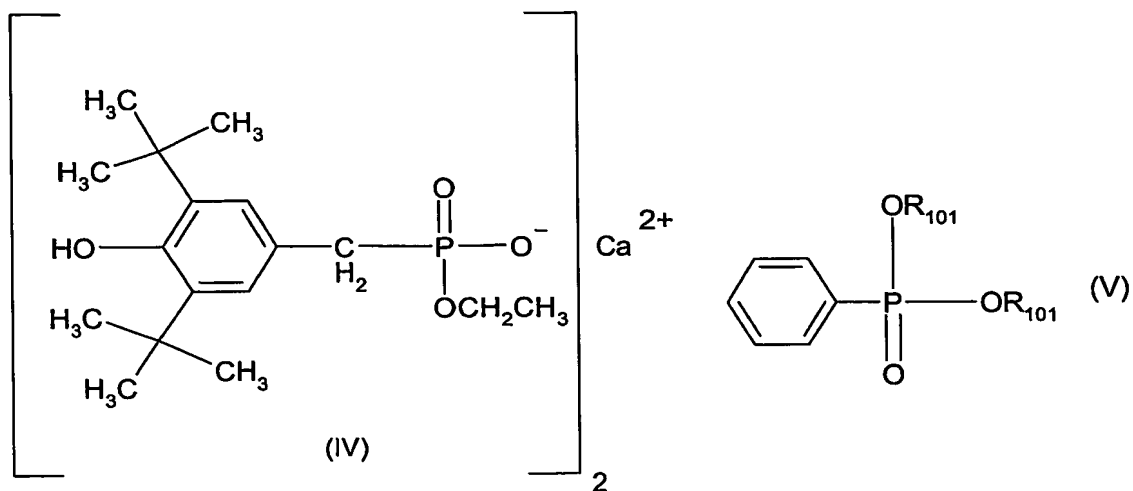
M^{r+} is an r-valent metal cation, r is 1, 2, 3 or 4; and

n is 1, 2, 3, 4, 5 or 6.

8. A process according to claim 1 wherein the phosphonate is of formula III, IV, V, VI or VII



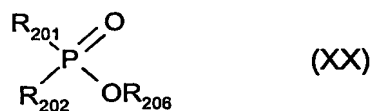
- 55 -



wherein the R_{101} are each independently of one another hydrogen or M^{n+} / r.;

5

9. A process according to claim 1 wherein the phosphinates are of the formula XX



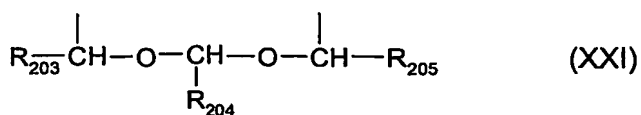
wherein

10

R_{201} is hydrogen, C_1 - C_{20} alkyl, phenyl or C_1 - C_4 alkyl substituted phenyl; biphenyl, naphthyl, $-CH_2-O-C_1-C_{20}$ alkyl or $-CH_2-S-C_1-C_{20}$ alkyl,

R_{202} is C_1 - C_{20} alkyl, phenyl or C_1 - C_4 alkyl substituted phenyl; biphenyl, naphthyl, $-CH_2-O-C_1-C_{20}$ alkyl or $-CH_2-S-C_1-C_{20}$ alkyl, or R_1 and R_2 together are a radical of the formula XXI

15



- 56 -

wherein

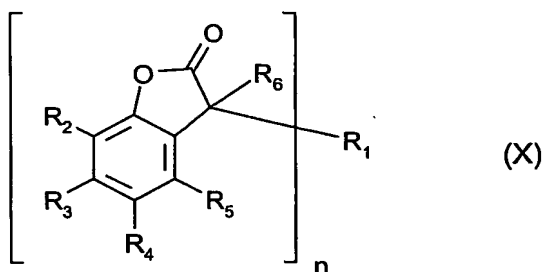
R_{203} , R_{204} and R_{205} independently of each other are C_1 - C_{20} alkyl, phenyl or C_1 - C_4 alkyl substituted phenyl;

R_{206} is hydrogen, C_1 - C_{18} alkyl or the ion of an alkali metal or the ammonium ion or

5 R_{206} is a direct bond, which forms together with R_{202} an aliphatic or aromatic cyclic ester.

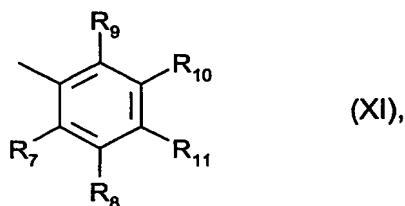
10. A process according to claim 1 wherein the benzofuran-2-one type compound is of formula X

10



wherein, if $n = 1$,

15 R_1 is naphthyl, phenanthryl, anthryl, 5,6,7,8-tetrahydro-2-naphthyl, 5,6,7,8-tetrahydro-1-naphthyl, thienyl, benzo[b]thienyl, naphtho[2,3-b]thienyl, thianthrenyl, dibenzofuryl, chromenyl, xanthenyl, phenoxathiinyl, pyrrolyl, imidazolyl, pyrazolyl, pyrazinyl, pyrimidinyl, pyridazinyl, indoliziny, isoindolyl, indolyl, indazolyl, purinyl, quinoliziny, isoquinolyl, quinolyl, phthalazinyl, naphthyridinyl, quinoxaliny, quinazolinyl, cinnoliny, pteridinyl, carbazolyl, β -carboliny, phenanthridinyl, acridinyl, perimidiny, phenanthroliny, phenazinyl, isothiazolyl, 20 phenothiazinyl, isoxazolyl, furazanyl, biphenyl, terphenyl, fluorenyl or phenoxazinyl, each of which is unsubstituted or substituted by C_1 - C_4 alkyl, C_1 - C_4 alkoxy, C_1 - C_4 alkylthio, hydroxy, halogen, amino, C_1 - C_4 alkylamino, phenylamino or di(C_1 - C_4 alkyl)amino, or R_1 is a radical of formula XI



- 57 -

and,

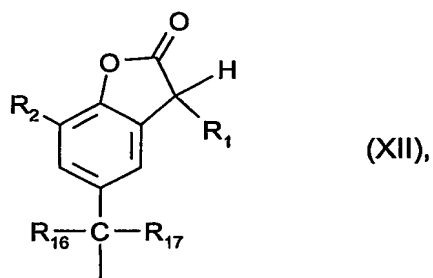
if $n = 2$,

- 5 R_1 is unsubstituted or C_1 - C_4 alkyl- or hydroxy-substituted phenylene or naphthylene; or $-R_{12}-X-R_{13}-$,

- R_2 , R_3 , R_4 and R_5 are each independently of one another hydrogen, chloro, hydroxy, C_1 - C_{25} -alkyl, C_7 - C_9 phenylalkyl, unsubstituted or C_1 - C_4 alkyl-substituted phenyl; unsubstituted or
- 10 C_1 - C_4 alkyl-substituted C_5 - C_8 cycloalkyl; C_1 - C_{18} alkoxy, C_1 - C_{18} alkylthio, C_1 - C_4 alkylamino, di(C_1 - C_4 -alkyl)amino, C_1 - C_{25} alkanoyloxy, C_1 - C_{25} alkanoylamino, C_3 - C_{25} alkenoyloxy;

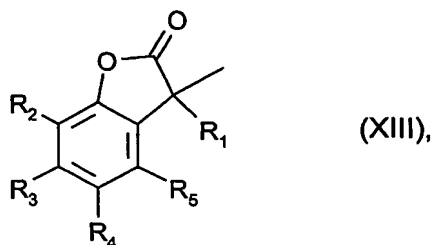
C_3 - C_{25} alkanoyloxy which is interrupted by oxygen, sulfur or $\text{>N}-R_{14}$; C_6 - C_9 cycloalkylcar-

- bonyloxy, benzoyloxy or C_1 - C_{12} alkyl-substituted benzoyloxy; or R_2 and R_3 , or R_3 and R_4 , or R_4 and R_5 , together with the linking carbon atoms, form a benzene ring, R_4 is additionally
- 15 $-(CH_2)_p-COR_{15}$ or $-(CH_2)_qOH$ or, if R_3 , R_5 and R_6 are hydrogen, R_4 is additionally a radical of formula XII



- 20 wherein R_1 is as defined above for $n = 1$, R_6 is hydrogen or a radical of formula XIII

- 58 -



wherein R_4 is not a radical of formula XII, and R_1 is as defined above for $n = 1$,

R_7 , R_8 , R_9 , R_{10} and R_{11} are each independently of one another hydrogen, halogen, hydroxy,

5 C_1 - C_{25} alkyl; C_2 - C_{25} alkyl which is interrupted by oxygen, sulfur or >N-R_{14} ; C_1 - C_{25} alkoxy;

C_2 - C_{25} alkoxy which is interrupted by oxygen, sulfur or >N-R_{14} ; C_1 - C_{25} alkylthio, C_3 - C_{25} -

alkenyl, C_3 - C_{25} alkenyloxy, C_3 - C_{25} alkynyl, C_3 - C_{25} alkynyloxy, C_7 - C_9 phenylalkyl, C_7 - C_9 phenyl-

alkoxy, unsubstituted or C_1 - C_4 alkyl-substituted phenyl; unsubstituted or C_1 - C_4 alkyl-substi-

10 C_1 - C_4 alkyl-substituted C_5 - C_8 cycloalkyl; unsubstituted or C_1 - C_4 alkyl-substituted

C_5 - C_8 cycloalkoxy; C_1 - C_4 alkylamino, di(C_1 - C_4 alkyl)amino,

C_1 - C_{25} alkanoyl; C_3 - C_{25} alkanoyl which is interrupted by oxygen, sulfur or >N-R_{14} ;

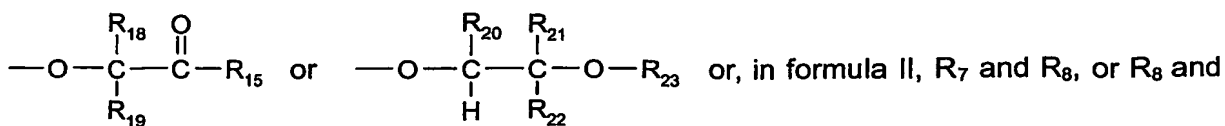
C_1 - C_{25} alkanoyloxy; C_3 - C_{25} alkanoyloxy which is interrupted by oxygen, sulfur or >N-R_{14} ;

C_1 - C_{25} alkanoylamino, C_3 - C_{25} alkenoyl; C_3 - C_{25} alkenoyl which is interrupted by oxygen, sulfur

or >N-R_{14} ; C_3 - C_{25} alkenoyloxy; C_3 - C_{25} alkenoyloxy which is interrupted by oxygen, sulfur

15 or >N-R_{14} ; C_6 - C_9 cycloalkylcarbonyl, C_6 - C_9 cycloalkylcarbonyloxy, benzoyl or

C_1 - C_{12} alkyl-substituted benzoyl; benzoyloxy or C_1 - C_{12} alkyl-substituted benzoyloxy;



R_{11} , together with the linking carbon atoms, form a benzene ring,

- 59 -

R₁₂ and R₁₃ are each independently of the other unsubstituted or C₁-C₄alkyl-substituted phenylene or naphthylene,

R₁₄ is hydrogen or C₁-C₈alkyl,

R₁₅ is hydroxy, $\left[-O^- \frac{1}{r} M^{r+} \right]$, C₁-C₁₈alkoxy or $-N \begin{matrix} R_{24} \\ R_{25} \end{matrix}$,

- 5 R₁₆ and R₁₇ are each independently of the other hydrogen, CF₃, C₁-C₁₂alkyl or phenyl, or R₁₆ and R₁₇, together with the linking carbon atom, are a C₅-C₈cycloalkylidene ring which is unsubstituted or substituted by 1 to 3 C₁-C₄alkyl;

R₁₈ and R₁₉ are each independently of the other hydrogen, C₁-C₄alkyl or phenyl,

R₂₀ is hydrogen or C₁-C₄alkyl,

- 10 R₂₁ is hydrogen, unsubstituted or C₁-C₄alkyl-substituted phenyl; C₁-C₂₅alkyl; C₂-C₂₅alkyl

which is interrupted by oxygen, sulfur or >N-R_{14} ; C₇-C₉phenylalkyl which is unsubstituted or substituted at the phenyl moiety by 1 to 3 C₁-C₄alkyl;

C₇-C₂₅phenylalkyl which is interrupted by oxygen, sulfur or >N-R_{14} and which is unsubstituted or substituted at the

phenyl moiety by 1 to 3 C₁-C₄alkyl, or R₂₀ and R₂₁, together with the linking carbon atoms,

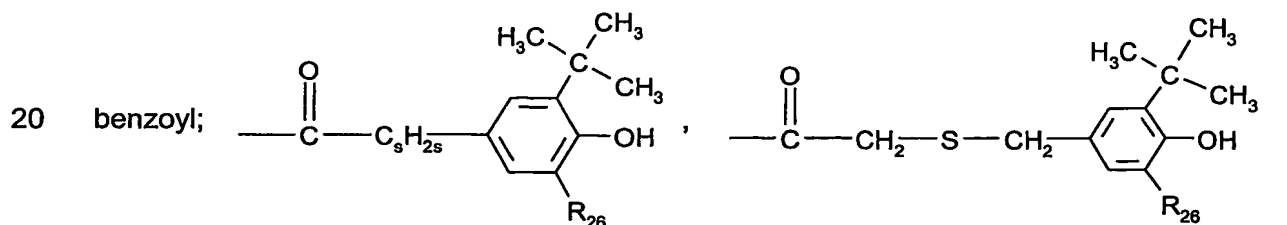
- 15 form a C₅-C₁₂cycloalkylene ring which is unsubstituted or substituted by 1 to 3 C₁-C₄alkyl;

R₂₂ is hydrogen or C₁-C₄alkyl,

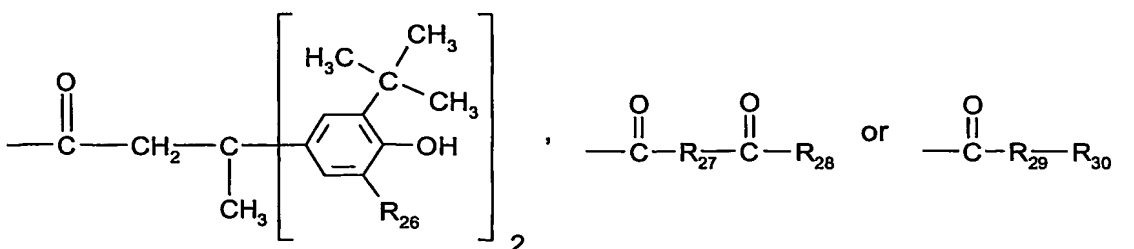
R₂₃ is hydrogen, C₁-C₂₅alkanoyl, C₃-C₂₅alkenoyl; C₃-C₂₅alkanoyl which is interrupted by

oxygen, sulfur or >N-R_{14} ; C₂-C₂₅alkanoyl which is substituted by a di(C₁-C₆alkyl)phos-

phonate group; C₆-C₉cycloalkylcarbonyl, thenoyl, furoyl, benzoyl or C₁-C₁₂alkyl-substituted



- 60 -

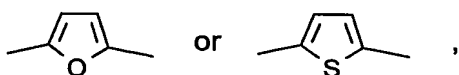


R_{24} and R_{25} are each independently of the other hydrogen or C_1 - C_{18} alkyl,

R_{26} is hydrogen or C_1 - C_8 alkyl,

R_{27} is a direct bond, C_1 - C_{18} alkylene; C_2 - C_{18} alkylene which is interrupted by oxygen, sulfur or

- 5 N-R_{14} ; C_2 - C_{18} alkenylene, C_2 - C_{20} alkylidene, C_7 - C_{20} phenylalkylidene, C_5 - C_8 cyclo-alkylene, C_7 - C_8 bicycloalkylene, unsubstituted or C_1 - C_4 alkyl-substituted phenylene,



R_{28} is hydroxy, $\left[\text{---O}^- \frac{1}{r} \text{M}^{r+} \right]$, C_1 - C_{18} alkoxy or $\begin{array}{c} \text{R}_{24} \\ \diagup \\ \text{N} \\ \diagdown \\ \text{R}_{25} \end{array}$,

R_{29} is oxygen, -NH- or $\begin{array}{c} \text{O} \\ \parallel \\ \text{N---C---NH---R}_{30} \end{array}$,

- 10 R_{30} is C_1 - C_{18} alkyl or phenyl,

R_{31} is hydrogen or C_1 - C_{18} alkyl,

M is an r-valent metal cation,

X is a direct bond, oxygen, sulfur or -NR₃₁- ,

n is 1 or 2,

- 15 p is 0, 1 or 2,

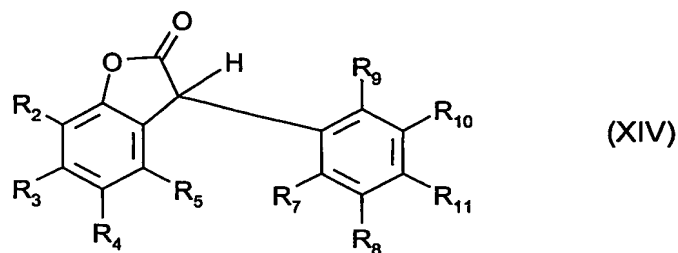
q is 1, 2, 3, 4, 5 or 6,

r is 1, 2 or 3, and

s is 0, 1 or 2.

- 20 11. A process according to claim 10 wherein the benzofuran-2-one type compound is of formula XIV

- 61 -



wherein

R₂ is hydrogen or C₁-C₆alkyl,

5 R₃ is hydrogen,

R₄ is hydrogen or C₁-C₆alkyl,

R₅ is hydrogen,

R₇, R₈, R₉, R₁₀ and R₁₁ are each independently of one another hydrogen, C₁-C₄alkyl, C₁-C₄-

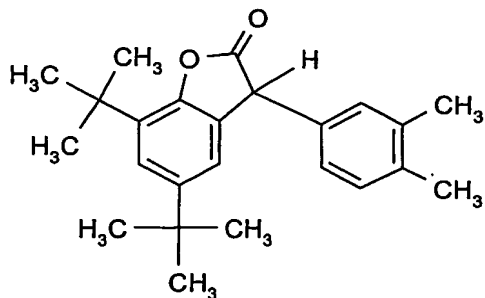
alkoxy or $\text{—O—}\begin{array}{c} \text{R}_{20} \quad \text{R}_{21} \\ | \quad | \\ \text{C} \text{—} \text{C} \text{—} \text{O—R}_{23} \\ | \quad | \\ \text{H} \quad \text{R}_{22} \end{array}$, with the proviso that at least two of R₇, R₈, R₉, R₁₀ or

10 R₁₁ are hydrogen,

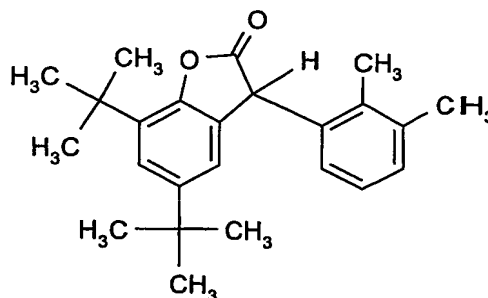
R₂₀, R₂₁ and R₂₃ are hydrogen, and

R₂₃ is C₂-C₄alkanoyl.

12. A process according to claim 11 wherein the benzofuran-2-one type compound is of
15 formula XIVa or XIVb



(XIVa)

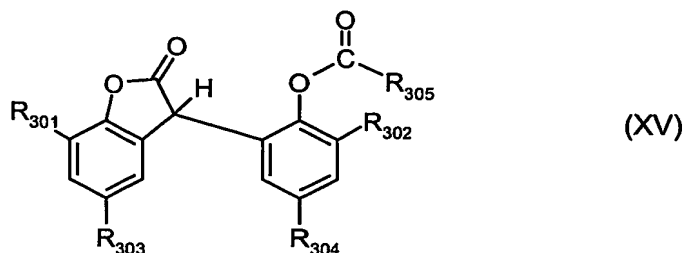


(XIVb)

or a mixture or blend of the two compounds of formulae XIVa and XIVb.

- 62 -

13. A process according to claim 1 wherein the benzofuran-2-one type compound is of formula XV



5 wherein

R_{301} and R_{302} are each independently of one another hydrogen or C_1 - C_8 alkyl,
 R_{303} and R_{304} are each independently of one another C_1 - C_{12} alkyl, and
 R_{305} is C_1 - C_7 alkyl.

10 14. A process according to claim 1 wherein the bis-acyllactam is used in an amount of 0.01 to 5 % by weight based on the weight of the polycondensate.

15 15. A process according to claim 1 wherein the phosphite, phosphinate or phosphonate is used in an amount of 0.01 to 5 % by weight based on the weight of the polycondensate.

16. A process according to claim 1 wherein the benzofuran-2-one type compound is used in an amount of 0.01 to 5 % by weight based on the weight of the polycondensate.

20 17. A process according to claim 1 wherein the ratio of the bis-acyllactam to the phosphite, phosphinate, phosphonate or to the benzofuran-2-one type compound or the sum of all is from 1:10 to 5:1.

25 18. A process according to claim 1 wherein the maximum mass-temperature of the melt is from 170° to 320° C.

19. A process according to claim 1 wherein an oxazoline compound is additionally present.

20. A composition comprising

- 30 a) a polycondensate;
 b) at least one bis-acyllactam;

- 63 -

- c1) at least one phosphite, phosphinate or phosphonate; or
- c2) at least one benzofuran-2-one type compound or
- c3) at least one phosphite, phosphinate or phosphonate and one benzofuran-2-one type compound.

5

21. A polycondensate obtainable by a process according to claim 1.

22. Use of a mixture of

a) at least one bis-acyllactam;

10

b1) at least one phosphite, phosphinate or phosphonate; or

b2) at least one benzofuran-2-one type compound or

b3) at least one phosphite, phosphinate or phosphonate and one benzofuran-2-one type compound

15

for increasing the molecular weight, for the modification and/or for reducing yellowing of a polycondensate.